Chandra X-ray Center (CXC)
Education and Public Outreach (E&PO)
Implementation Plan
(FY 2005)

Introduction

The Chandra X-ray Observatory is the third of NASA's Great Observatories. Chandra is a powerful tool available to astronomers world wide to observe hot (millions of degrees Celsius) regions of the universe where the physics of X-ray emitting sources such as black holes, pulsars, exploding stars, and colliding galaxies can be explored. Chandra is used to study some of the fundamental science questions about our cosmos, such as: What are "dark matter" and "dark energy"? How are black holes created, and how do they grow? What forces shape the destiny of our Milky Way galaxy? How do stars and galaxies recycle the elements necessary for life?

The Chandra mission was launched in 1999, and has entered its second five years of science operations. The Chandra X-ray Center (CXC) is tasked with carrying out an education and public outreach (E&PO) program to convey the results of Chandra's on-going mission of science discovery to broad and diverse segments of the American public, and interested publics world wide.

NASA recognizes three broad areas for the categorization of E&PO efforts: press, informal education and outreach, and formal education. Chandra E&PO goals and resultant implementation activities are aligned with these three areas.

Over the past few years, NASA has carried out a major reorganization of its education program. Several new areas of focus made a significant impact on the conduct of E&PO. Among them were training the next generation of NASA workers through an emphasis on science, technology, engineering and mathematics (STEM) related education activities; adopting a customer-driven focus; strongly emphasizing diversity; and ensuring that all activities embody the concept "As Only NASA Can". The CXC E&PO goals, strategy, and core activities embody the elements of the new NASA education mission.

Program Goals that Guide Priorities

Chandra E&PO program goals are aligned with current NASA E&PO policy:

- Inspire the next generation of explorers - AS ONLY NASA CAN
- Exemplify NASA philosophy: Explore, Discover, Understand
- Increase public engagement and support for NASA's space science missions
- Convey excitement of Chandra discoveries
- Provide broad and ready access to Chandra images, information and education products
- Promote science literacy and increase learning opportunities in the NASA-emphasized fields of science, technology, engineering and math (STEM)
- Provide opportunities for authentic science research in the classroom
- Provide opportunities for science community participation
- Provide opportunities for participation by, and inclusion of, diverse populations
- Identify and respond to E&PO customer needs
- Assess and evaluate for E&PO program relevance and effectiveness, maximize resources

E&PO Program Strategies

The Chandra E&PO program is implemented through two main categories of activities, core activities and discretionary activities.

- Core activities are the primary means by which program goals are fulfilled, and are the backbone of the program. Core activities are selected based on program and policy considerations, as well as on user feedback and evaluation.
- Discretionary, or ad-hoc, activities, are those non-scheduled tasks and activities that may be proposed during the year from a variety of sources. Adjustments to the program are made during the year based on analysis of metrics, user comments and other forms of feedback, as well as new opportunities to leverage existing programs or to achieve high impact.

To fulfill E&PO goals defined for the Chandra extended mission contract, we select activities based on the following criteria:

- Align with NASA policies and goals
- Create a comprehensive, balanced program across the three key areas of press, informal outreach and education, and formal education
- Utilize unique contributions from NASA and Chandra mission and science
- Create coherent product and activity lines with internal leverage and re-use potential
- Maximize the use of staff skills and flexibility and of CXC staffing and funding resources
- Leverage or collaborate with NASA (or other) high impact programs
- Make maximum use of existing NASA E&PO and E&PO ecosystem resources
- Incorporate customer feedback and assessment from current activities

- Make use of lessons learned from other SMD E&PO programs
- Emphasize widespread dissemination and ease of access to materials and programs
- Target diverse audiences

Our strategy of incorporating both planned and discretionary activities allows us to maximize E&PO program resources by being able to accommodate changing circumstances or policies, to take advantage of new opportunities that arise, to react to feedback from metrics, assessment, and user comments and trends, to take advantage of opportunities to leverage existing programs or to initiate activities with high impact potential, and to flexibly utilize the range of staff skills across multiple program areas.

A concern unique to Chandra has been the long hiatus between X-ray astronomy missions. The last US X-ray mission was the Einstein Observatory which ended in 1978. A US-German mission, ROSAT, ended in 1990. A key focus in our approach to products and activities has been and continues to be basic public familiarization with this area of science and with the unique role of NASA in providing the space-based missions necessary to carry it out.

Core Activities

The Chandra E&PO plan identifies core activities by "customer" in each of the three key areas covered by the E&PO program. The core activities are monitored and evaluated to ensure that they respond to

a) NASA direction and policy;

b) customer needs; and

c) metrics that track impact and efficacy.

Core activities and products by customer and key area:

Press

- NASA Science Updates
- Media Telecons
- Press releases, press conferences (including video file, additional images, background information)
- Providing images, animations, video and text in multiple formats (digicam, betacam, VHS, CD, DVD, etc.) for broad media access
- Arranging press contact with scientists and press officers
- Maintaining regular EPO contact with the science community to find newsworthy stories and to encourage scientist participation in press activities
- Animation and video resource library for broadcast and web media

General Public (Informal Outreach)

- Web based images, science content, feature stories, interactives, downloadable products, access to scientists
- Current, frequently updated descriptions and explanations of discoveries and background science, tailored for general audiences
- Multi-media products tailored for general audiences

- Widespread proactive dissemination of print and multi-media products (posters, lithographs, CDs etc.) to a variety of audiences
- Participation in national and regional public and amateur events
- Collaboration with other NASA programs and science institutions
- Pro-active compliance with web and media access regulations for disabilities
- Inclusion of diverse populations through targeted material distributions

Educators and Students (Formal Education)

- Standards-based materials for use in classroom (web and print)
- Content rich web site for background, research, student projects
- Teacher enrichment program, pre-service and in-service training
- Access to Chandra data, software and related activities adapted for classroom use
- Participation in national, regional, and local education events
- Multi-media products tailored for educational use
- Inclusion of diverse populations through targeted workshops and presentations

Special Interests (Informal Outreach and Formal Education)

We produce tailored products derived primarily from press and informal products to meet the needs of customers such as museums, planetaria, commercial and educational product developers, publishers, and multi-media producers. These products generally require special processing such as custom editing, custom formats, technical advice for high quality reproduction, conversion to different media or different software, making CDROMs or DVDs for very large format requests, and converting to betacam or digicam formats.

Science Community (Informal Outreach and Formal Education)

- Operating the Chandra EPO supplemental grant program, including the proposal peer review
- Providing opportunities for scientist involvement in EPO product development and review, and in other EPO activities such as public talks, open house events
- Creating and providing Chandra exhibits at science meetings
- Maintaining a on-line library of PowerPoint and PDF slides for teaching, public lectures or other talks

Discretionary Activities

In addition to core activities, our flexible E&PO implementation strategy accommodates additional, discretionary activities that are requested or suggested by NASA, the broader NASA and SMD outreach community, program staff, or our community of users. Such flexibility maximizes efficiency and return on our E&PO resources by leveraging existing resources or products to take advantage of high impact opportunities that could not be pre-planned.

These opportunities and requests are addressed, as resources allow, within the framework of the Chandra E&PO mission goals, the CXC contract's Statement of Work, and the current focus of NASA's E&PO policy. Key considerations in choosing discretionary activities are customer needs, opportunities with

broad impact or ability to reach diverse or target audiences, and leverage from other NASA or SMD mission activities.

Examples of such activities carried out in 2004-5 are:

- Video loops about Chandra science and operations for the Structure and Evolution of the Universe (SEU) Forum's Cosmic Questions traveling museum exhibit, which reaches approximately 2 million visitors at each venue. Among the materials supplied were tailored excerpts from the film loops prepared for the Chandra exhibits at the American Astronomical Society (AAS) meetings and excerpts from video prepared for recent press and NSU events.
- Participation in the Hubble Space Telescope (HST) View Space (VS) program, by supplying specially formatted digital materials from the latest Chandra press releases to VS on a monthly basis. View Space has over 120 displays in museums and planetariums that host VS. This activity helps Chandra press materials reach a wide audience through a medium with high personal impact.
- Developing and producing a thematic wall poster insert for the February 2005 National Science Teacher Magazine with ~ 29,000 subscribers. Our informal education web piece on the stellar cycle was identified as suitable content and was converted into a wall poster that met the criteria for a formal education product, including alignment with national teaching standards.

Strategic Planning Cycle

Five Year Interval

At the successful completion of its first 5 years, the Chandra program was reviewed and granted an extended 5 year mission. A five-year planning cycle (starting 2004) provided the overall framework for staff resources and budget against which the Chandra E&PO program is implemented. Overall goals were set, core activities outlined and prioritized, and resources reviewed and allocated by key program area against the framework of NASA and SMD policy and Chandra-specific goals.

Yearly Interval

The E&PO program goals and resource allocation are reviewed yearly, in conjunction with the CXC fiscal year planning and budgeting cycle, providing the opportunity for adjustments in strategy and resource allocation for tasks and activities.

Monthly Interval

Metrics in all key program areas are collected and reviewed monthly in conjunction with the mandatory monthly CXC Program report. Issues highlighted by these statistics and comments received though the public web site are incorporated into the strategic planning process.

Bi-Weekly, Weekly or Ad Hoc Interval

Reports highlighting key accomplishments and metrics are prepared for bi-weekly CXC staff meetings. The E&PO group holds topical project and status meetings at least weekly. Reviews and revisions may occur as needed in response to changes in NASA E&PO policy, to identified trends in metrics or other expressions of customer needs, or to newly discovered opportunities for broad impact or high leverage.

Evaluation

Independent Evaluation

NASA organizes a yearly Independent Implementation Review as part of its oversight of the CXC, as well as quarterly reviews. These reviews generate recommendations and action items that are incorporated into program planning and implementation.

The Chandra Users Committee conducts a program review on a bi-annual basis. These reviews generate recommendations and action items that are incorporated into program planning and implementation.

Education workshops and presentations are evaluated through detailed participant questionnaires and pre and post testing as appropriate. Educational materials undergo extensive evaluation during the development process as well as several rounds of review and revision as a result of field testing both at educator workshops and in classroom settings. In addition, mature products are submitted to the NASA education product review.

An independent program evaluator will conduct overall program assessment.

Metrics

The tracking and use of metrics is carried out at a level feasible with the available staff. Our metrics supply data for required reports and provide a basis for adjusting our program activities to maximize effectiveness based on user feedback, quantitative, and in the form of comments.

We track and compile a set of metrics to support mandatory bi-weekly, monthly and quarterly reports. We compile an additional set of metrics needed for the detailed and extensive End of Year Report required by NASA Education. We provide other data sets as requested from time to time by the Chandra Program Office at MSFC, SMD or NASA Education .

We utilize metrics that primarily measure our products and user contacts quantitatively. Each month we compile and review statistics on the number and placement of press stories, visits to web pages and web activities, requests for printed materials, and permissions for image and content use. We compile and review as received, more detailed, generally qualitative, comments from workshop evaluations, and requests or comments from “customers” such as press, multi-media publishers, science institutions and educators. In addition, the CXC public web site includes a “guest book” where visitors have the option to leave comments. Both statistics and comments are used as input to program and product review. The two “high level” measures of efficacy are numbers of uses (both in absolute numbers and change from previous periods) and user comments and evaluations.